Feb. 20, 1923. 1,446,145.

J. W. ALLAN.

FURNACE.

FILED JULY 11, 1918.

3 SHEETS—SHEET 1.

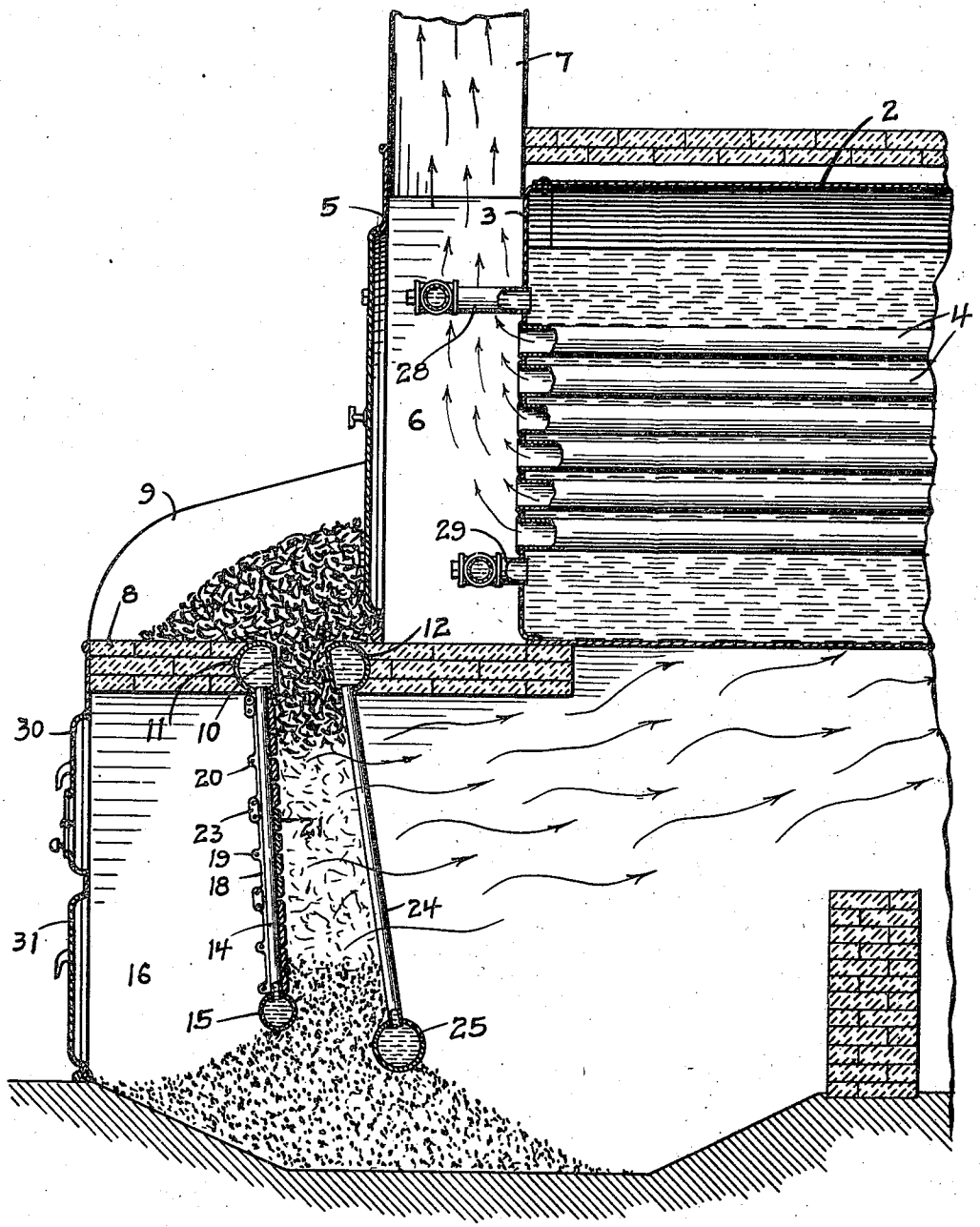


Fig 1.

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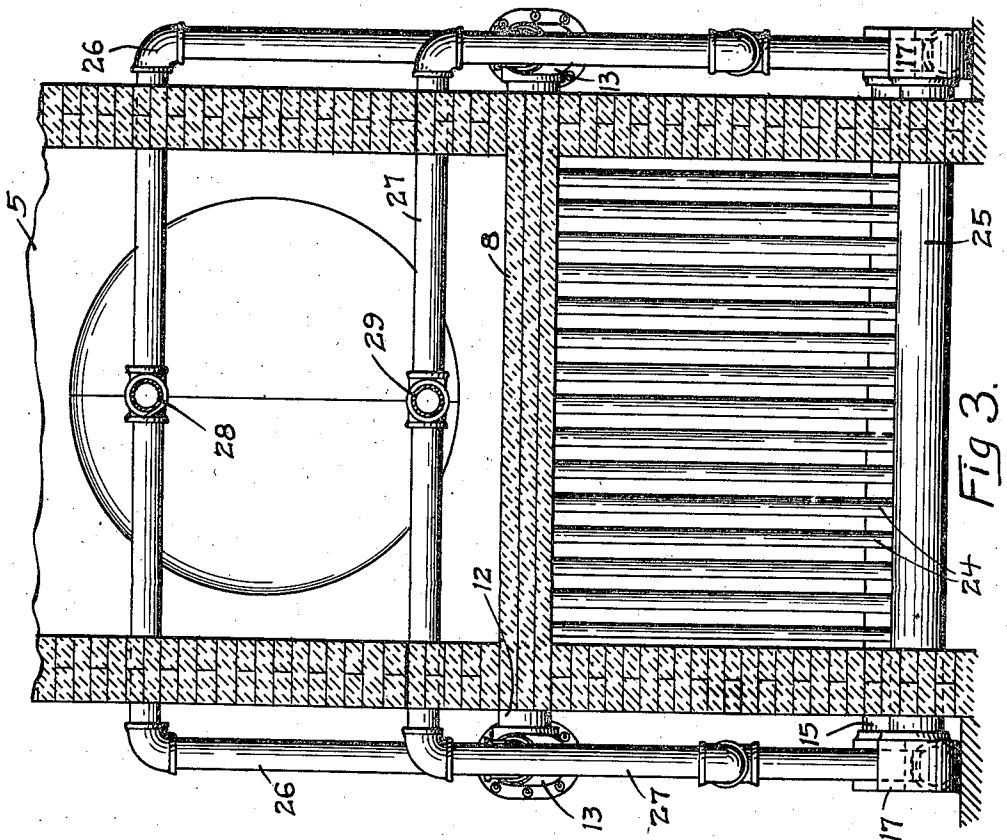


Fig 3.

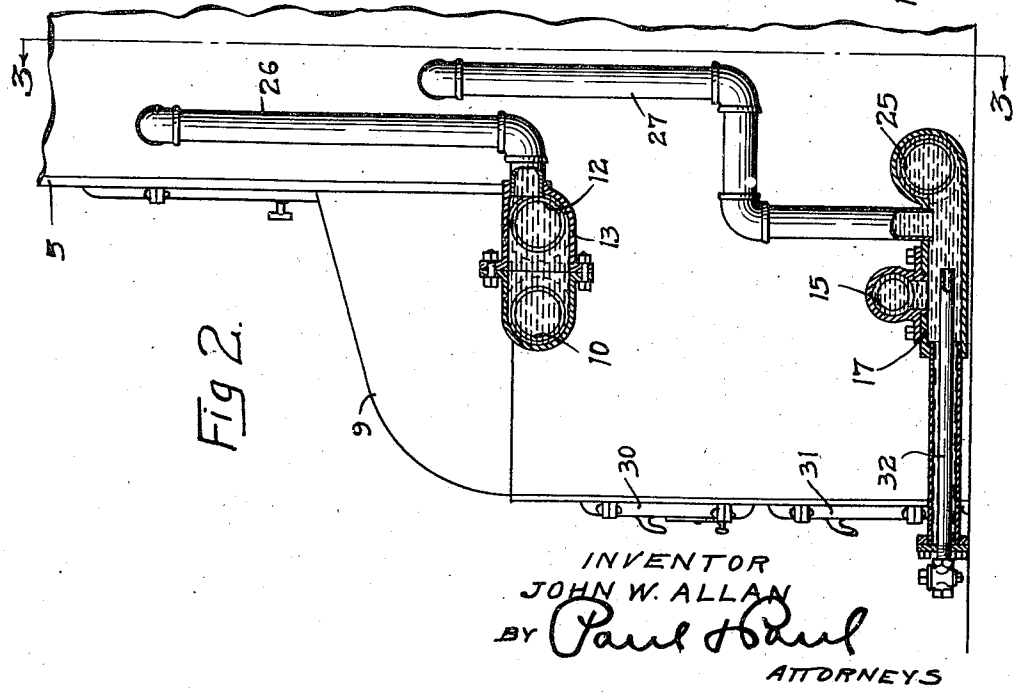


Fig 2.

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FILED JULY 11, 1918. 3 SHEETS—SHEET 3.

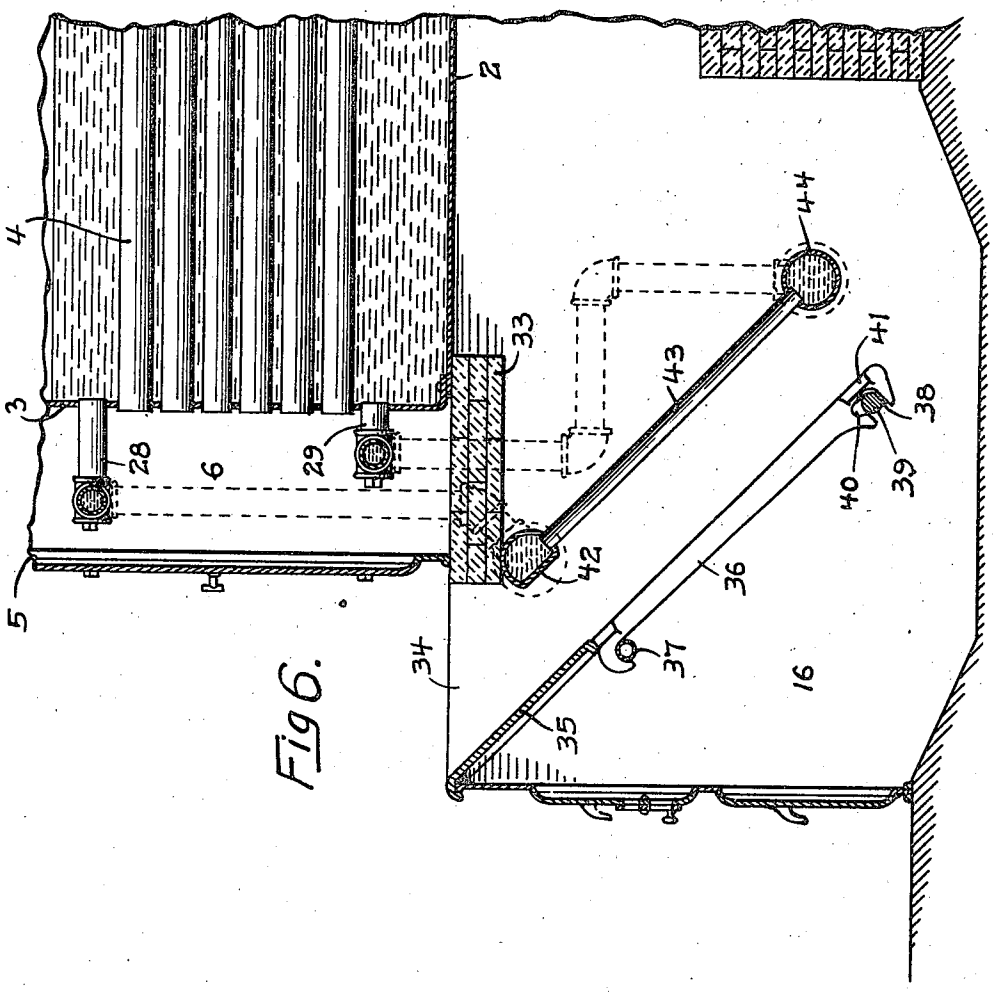


Fig 6.

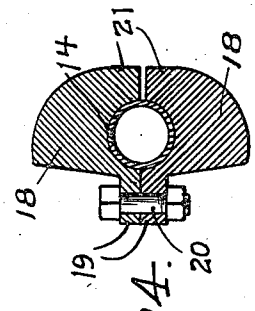


Fig 4.

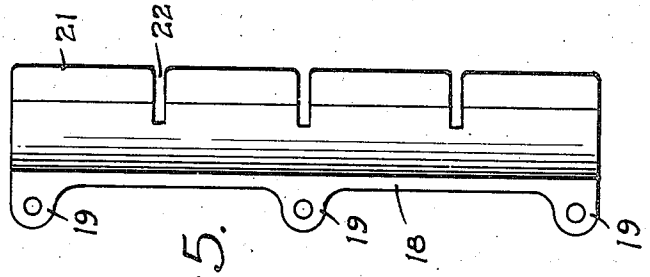


Fig 5.

INVENTOR
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Patented Feb. 20, 1923. 1,446,145

UNITED STATES PATENT OFFICE.

JOHN W. ALLAN, OF MINNEAPOLIS, MINNESOTA.

FURNACE.

Application filed July 11, 1918. Serial No. 244,458.

To all whom it may concern:

Be it known that I, JOHN W. ALLAN, a citizen of the United States, resident of Minneapolis, county of Hennepin, State of Minnesota, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

My invention relates to an attachment for a furnace or boiler and has for its object to provide more perfect combustion of the fuel and hence economy in its use, greater ease of operation and less care than is usually required for apparatus of this kind.

A further object is to provide an attachment which can be applied to the front of any ordinary steam or hot water boiler.

Other objects of the invention will appear from the following detailed description,

The invention consists generally in various constructions and combinations, all as hereinafter described and particularly pointed out in the claims.

In the accompanying drawings forming part of this specification,

Figure 1 is a vertical sectional view through the front of the boiler with my invention applied thereto,

Figure 2 is a side elevation showing the manifolds at the sides of the boiler in cross section,

Figure 3 is a sectional view on the line 3—3 of Figure 2,

Figures 4 and 5 are detail views of the construction of the front grate, and the means for mounting the sections thereof on the grate tubes,

Figure 6 is a vertical sectional view of the front of the boiler, showing a modified construction of the fuel grate.

In the drawing, 2 represents a boiler of ordinary construction, having a crown-sheet 3 and flues 4 mounted therein, 5 represents the head of the boiler and 6 a box between the head and the crown sheet through which the products of combustion flow to the pipes 7 leading to the stack. 8 represents a horizontal deck arranged beneath the box 6 and the crown sheet of the boiler and projecting in front of the head 5 and provided on each side with upright guard plates 9. This deck in front of the plate 5 forms a magazine whereon the fuel to be consumed is placed.

A feed opening 10 is provided in the deck 8 through which the fuel is fed by gravity to the grates beneath and on each side of this feed opening I provide headers 11 and 12 in the form of water boxes having flat opposing faces and joined together at their ends by means of suitable manifolds 13. The header 11 has a series of tubes 14 depending therefrom and connected at their lower ends to a header 15 which extends transversely of the chamber 16 below the deck 8 and is connected at its ends to a manifold 17.

To protect the tubes 14 from being burned out and at the same time prevent these water tubes from retarding ignition, I provide a grate made up of a series of cast metal sections 18, curved to fit the walls of the tubes and having ears 19 thereon through which bolts 20 are inserted for securing the sections of the grate together and protecting the tubes and at the same time preventing the fire from being cooled to such an extent by the water tubes that ignition would be retarded. The sections 18 have webs 21 projecting into the fire separated by notches 22 which provide for expansion and contraction, while the webs protect the exposed walls of the tubes from direct contact with the flame. These sections 18, laid end to end on the water tube, are joined together by suitable means, such as links 23. The sections are preferably formed in cross section, as shown in Figure 4, with a considerable body of metal on each side of the tubes sufficient to space the tubes on approximately three inch centers though, of course, this distance may be varied according to the character of the installation and as conditions may make advisable.

The header 12 has a series of water tubes depending therefrom communicating at their lower ends with a header 25 extending transversely of the chamber 16 parallel with the header 15 and communicating with the manifold 17. Pipes 26 and 27 lead from the manifolds on each side of the boiler up into the chamber 6 where they have connections 28 and 29 with the boiler through the crown sheet 3. A circulation is thus established through the top and bottom headers and the water tubes between them, and the manifolds with the boiler.

In the front of the chamber 16 doors 30 and 31 are provided for observation purposes and for removal of the ashes which accumulate in the bottom of the chamber.

The fuel placed on the deck 8 is fed by gravity through the opening therein, similar to a magazine feed, and the space between the upper headers and the upper por-

tions of the water tubes forms a retort in which the fuel is distilled and the gases driven off which, flowing through the upper portions of the tubes 24, become ignited in the space beneath the rear portion of the deck or what may be termed the arch of the boiler. As the fuel descends, it becomes ignited and burns thoroughly as it slowly descends between the grates until at the bottom it is discharged in the form of an ash and with practically complete combustion. The rear grate 24 diverges slightly from the forward grate from the top to the bottom so that bridging or arching of the fuel between the grates is prevented, while said rear grate has the further function of preventing the fuel from avalanching or falling backward into the chamber. I have found this construction of the grate of particular importance in this boiler. It not only insures practically perfect combustion but eliminates clogging or bridging or the formation of clinkers and the comparatively slow, even combustion insures a high degree of efficiency and economy of operation. Freedom of circulation of the water through the tubes is provided by means of the ample space in the headers and the manifolds and the manifolds 17 are preferably provided with blow-off connections 32.

In Figure 6 I have shown a modified construction in which an arch 33 is shown under the forward portion of the boiler, with a magazine feed opening 34 in front of the arch having a hopper wall 35 and a grate 36 forming an inclined continuation of said wall on the lower side. This grate has its upper end supported by a tube 37 and its lower end has a notch 38 therein to receive a shaft 39 provided with a cam 40 which engages a lug 41 on the lower end of the grate for imparting a shaking movement to the grate when the shaft is revolved by suitable means, not shown. This constitutes in effect a mechanical stoker, as the agitation of the grate will accelerate the gravity feed of the fuel from the magazine above. A header 42 is mounted opposite the upper end of the grate 36 and has water tubes 43 communicating with a header 44, said headers being connected to pipes indicated by dotted lines with the connections 28 and 29 described with reference to Figure 1.

The grate 36 and the tubes 43 are arranged at an incline of about 45 degrees and the fuel fed between them will be distilled in the upper part of the space and the gases driven off in much the same manner as explained with reference to Figure 1, the principal difference in the two constructions being the arrangement and mounting of the grate 36 to form in effect a mechanical feed or stoker. This grate and the tubes 43 are substantially parallel, as with the agitating feature of the grate there will be no danger of arching or bridging of the fuel or clogging thereof in the space between the grate and the water tube. These water tubes will also have the function of preventing the fire from avalanching or falling over into the ash chamber beneath.

In both constructions illustrated in the drawings there is an unobstructed passage at the bottom of the firepot between the grates leading to the chamber 16 and into this passage clinkers, lumps of slate and other non-combustible material which may be in the fuel will be discharged and may be easily removed through the door in the front of the furnace. The discharge of the fuel from between the grates may, of course, be accelerated or retarded by removing the ashes accumulating on the floor of the chamber 16 or allowing them to collect and fill the space between the lower portion of the grates.

I claim is my invention:

1. The combination, with a boiler, of a deck supported beneath the same and having a fuel feed opening, headers mounted on said deck upon opposite sides of said opening, tubes depending from said headers, lower headers with which said tubes are connected respectively, transverse manifolds for said upper and lower headers, pipes connecting said manifolds with said boiler, said tubes forming respectively front and rear grates, and cast metal sections encircling said forward tubes and partially concealing and protecting the same and preventing direct contact of the fuel with said tubes, said cast metal sections comprising longitudinally divided members having curved inner faces to fit said tubes, said members having comparatively thick bodies of metal on the side of said tubes adjacent the fuel and on the opposite side having means for securing said sections together.

2. The combination, with a boiler, of a deck supported beneath the same and having a fuel feed opening, water headers mounted in said deck upon opposite sides of said opening, tubes depending from said headers, lower headers connected with said tubes, upper and lower manifolds for said headers and pipe connections therefor communicating with the boiler, said tubes forming front and rear grates, one of said grates having a series of cast metal sections fitting the inner face of the grate, said sections comprising webs projecting into the fire-pot between the grates and having transverse expansion notches along their inner edges, thereby protecting the water tubes from direct contact with the flames and also preventing the retarding of combustion through contact of the fuel with the tubes.

3. The combination, with a boiler, of a deck supported beneath the same and having a fuel feed opening, water headers mounted

in said deck upon opposite sides of said opening, tubes depending from said headers, lower headers connected with said tubes, upper and lower manifolds for said headers, pipe connections therefor communicating with the boiler, said tubes forming front and rear grates, one of said grates having a series of cast metal sections fitting the inner face of the grate, said sections comprising webs projecting into the fire-pot between the grates and having transverse expansion notches along their inner edges, thereby protecting the water tubes from direct contact with the flames and also preventing the retarding of combustion through contact of the fuel with the tubes, and links connecting the adjacent cast sections together on the outer side of the grate.

In witness whereof, I have hereunto set my hand this 27" day of June 1918:

JOHN W. ALLAN.